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ABSTRACT

This report is part of a paper set which focuses on a project designated as "Applying Research to Teacher Education (ARTE)." It reviews application possibilities of teacher effectiveness research in elementary classrooms to science teaching at the secondary level. Mills College (Oakland, California) was one of the sites involved in the project. A situational analysis of its teacher preparation program provided the bases for the development, implementation, and evaluation of techniques for applying research findings in both preservice and inservice teacher education programs. Four cooperating teachers and six student teachers of elementary school mathematics participated in the study. The project suggested that skill development in assessing student learning was needed and that training in measurement of academic learning time and active teaching behaviors with student and cooperating teachers would help. Highlights from the interviews of the participating student and cooperating teachers are presented. All participants reported changes in their teaching as a result of the project ideas and the associated feedback that they received about their teaching. The project was also noted to offer collaboration opportunities between teachers and research project personnel. (ML)

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Applying Teacher Effectiveness Findings to Preservice and Inservice Science Teacher Education

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Rationale for a Study of the Relevance of Academic Learning Time and Active Teaching Behaviors to Secondary Science Teacher Education

Introduction

This paper develops a rationale for studying the relevance of two ideas drawn from teacher effectiveness research in elementary classrooms to science teaching at the secondary level. The first section describes the basic elements in a larger research project with which the authors were associated. The second section describes our reasons for extending that project's ideas to secondary science teacher education and introduces the other two papers that are included in this set of reports. The final section of this paper presents relevant findings from interviews with participants in the larger project that focussed on the teaching of mathematics at the elementary level.

Applying Research to Teacher Education: A Study in Elementary Teacher Education

Under a grant from the National Institute for Education, the Far West Laboratory for Educational Research and Development selected three regional sites to participate in a project designed to apply and utilize research in elementary teacher education, officially designated as "Applying Research to Teacher Education (ARTE)." The three sites were Mills College, Oakland, CA; University of Utah, Salt Lake City, UT; and The University of Nevada, Reno, NV. The project was structured as a two-phase activity, with the first phase occuring in the period December 1982 through November 1983. Activities within phase one included (1) establishing a Regional Teacher Education Team, (2) developing a situational analysis at each site, (3) developing a research design to determine the effectiveness of strategies for utilization of research findings on effective teaching, and (4) developing a Teacher Education Academy. In this discussion we are concerned with the Mills College site, and we begin with a description of the Mills College teacher preparation program. Then we summarize the results of the situational analysis and describe the research design.

Teacher preparation at Mills College

The elementary (Multiple Subjects) and secondary (Single Subject) credential programs at Mills College were redesigned in 1973 to meet the State of California requirements under the Ryan Act. The design was compatible with the Mills tradition of liberal education for women and the values held for a high quality of professional training for educators. A major goal of the program at Mills is to integrate professional education and training by unifying theory and practice. A second goal is to link the training and experience of elementary and secondary credential candidates in order to unite them in an ongoing professional understanding and purpose. In pursuing these goals, the program has eliminated traditional course schedules and established a

program that permits flexibility in the time used for instruction as observation and participation in the classroom gradually increase. Elementary and secondary credential candidates share many experiences and intructional activities; they also meet separately for instruction in specific content areas. The faculty in the Education Department work as a team, coordinating activities and instruction in all program areas. Planning together, planning with students and cooperating teachers, evaluating each aspect of the program, and evaluating each student's performance are key goals of the Mills program design.

Student teaching at Mills includes observation and classroom participation that begin early in the first semester. The amount of time spent in field work is gradually increased as the student prepares for full-time student teaching. During the second semester, the student teacher is required to participate in all school activities normally expected of a teacher. Placements are selected to provide diversity in socio-economic and ethnic characteristics of pupils as well as different styles of classroom organization and teaching. Finally, we should note that the Mills College teacher preparation program operates on a small scale, with approximately twenty credential students each year, permitting careful attention by the faculty to the development of each student.

Situational analysis

The major purpose of the situational analysis was to present a broad view of the existing content and processes of the Mills College program to inform subsequent development of the application of effective instruction research in both preservice and inservice teacher education. Interviews with student teachers, college faculty, and cooperating teachers associated with the Mills program revealed little awareness or use of the teacher effectiveness research relating to "academic learning time" (ALT) or "active teaching behaviors" (ATB). Student teachers' information tends to come from casual conversations with cooperating teachers who are themselves fairly far removed from the primary sources of the research on teacher effectiveness. A basic strategy of building from awareness through knowledge and application to evaluation seemed appropriate, and specific training in observation techniques associated with ALT and ATB seemed promising. The situational analysis interviews also indicated that the cooperating teacher seems to serve as a "gatekeeper" for the student teacher, determining what processes and content are emphasized or excluded in the classroom. Requiring the assessment of certain teaching behaviors in the classrooms seemed likely to have interesting impact.

Research design

The goal of the ARTE study was to develop, implement, and evaluate techniques for applying research findings on effective instruction to the preservice preparation of teachers at the elementary level. The situational analysis suggested it would be appropriate to develop skills for assessing student learning as well as skills for assessing teaching behavior. One area of recent research related to effective instruction was developed by Fisher et al. (1980), who reported positive relationships between "academic learning time" (ALT) and achievement in

reading and mathematics at the elementary level. Academic learning time is defined as the fraction of time a student experiences a high or moderately high success rate, while engaged in academic learning within the time allocated for that subject by the teacher. Fisher et al. suggest that the measurement of ALT is one of the most visible indicators of learning while it is taking place. Thus ALT was selected as one of two basic effective instruction themes for the project.

Good (1983) has reported specific teaching behaviors that foster student learning in elementary school mathematics, and he labels these "active teaching behaviors" (ATB). Two basic features of active teaching behaviors are teacher direction of learning and a high level of teacher-student interaction. Other attributes of more effective teachers include the clear presentation of information, allowing students to initiate more academic questions, and creating a somewhat relaxed learning environment with comparatively little praise or criticism. Good also reports that more effective teachers expressed higher achievement expectations for their students.

It was decided that the project would train student teachers and cooperating teachers to measure academic learning time and active teaching behaviors in their classrooms. It was expected that a heightened knowledge of elements identified in research as having a positive impact on teaching and learning would increase ALT and ATB. The ability to measure ALT and ATB became the "research skills" for the student teachers and cooperating teachers participating in the project. It was hypothesized that as student and cooperating teachers became skilled in recognizing behaviors that have positive influence on student success, they would include more of those behaviors in their teaching. Thus the project proposed a model that promotes and depends upon the mutual openness of student and cooperating teachers to feedback related to their instructional effectiveness.

The project combined student teachers and their cooperating teachers as colleagues in training sessions to develop skills in measuring ALT and ATB. Collaboration and a goal of parity between student and cooperating teacher were encouraged, following elements of research described by Tikunoff and Mergendoller (1983). It was the project's intention to promote feedback between the student teacher and the cooperating teacher as they attempted to apply the new-found distinctions to their assessments and planning of classroom instruction. The combined training also provided a "common lexicon" for discussions of classroom practice.

This project was the first time Mills College has undertaken the simultaneous involvement of preservice and inservice teachers on research-based topics. If developing student teacher and cooperating teacher skills and knowledge of classroom instruction research strategies proves helpful in the development and use of effective instructional behaviors, the model will be incorporated into the Mills College teacher preparation program. The findings of the project have become the initial topics of a Teacher Education Academy convened by Mills, as a support structure for nearby teacher education institutions interested in collaborative research with one or more school districts.

Applying Teacher Efffectiveness Findings to Preservice and Inservice Science Teacher Education

When Russell arrived at Mills College as a visiting scholar and joined Ponzio and Bowyer for the 1983-84 academic year, their shared backgrounds in science education suggested the value of collaboration on a research project in science education. Ponzio was already immersed in the ARTE project as a Regional Research Fellow for one of the three sites; Bowyer and Russell participated in one or more phases of that project and were interested in the basic goal of training student and cooperating teachers in research skills for mutual feedback, with teacher effectiveness research findings as a starting point. The three of us shared interests in staff development and in the influence of feedback on the development of beginning teachers. We very quickly agreed that it would be valuable to explore the application of the ALT and ATB ideas in science teacher education at the secondary level.

Within the relatively small number of students in the teacher preparation program at Mills College, there were three students assigned in secondary science during the fall semester of 1983. The assignments were in biology, physics, and junior high science. Visits were made to each classroom to invite the cooperating teacher and student teacher to attend a training session in ALT and ATB and then provide us with data about the resulting use of the new ideas. A three-hour training session is, of course, an extremely short time to present the ideas and we were pleased with the resulting level of interest by the six participants. There were no miraculous transformations of teaching behavior or supervisory relationships. Given the very limited nature of our intervention, it did not seem productive to seek the quantitative data that orignally seemed appropriate. In the other two papers in this set, Bowyer discusses the reactions of the six participants to the opportunity the training provided to talk about and apply ideas based in classroom research, while Russell reports a case study of one of the student teachers who focussed on the coding of active teaching behaviors.

Results of the ARTE Elementary-Level Research Project

To complete this discussion of the rationale and background to our study of the application of teacher effectiveness findings to preservice and inservice science teacher education, we report highlights and themes from our recently completed interviews of four cooperating teachers and six student teachers who participated in the Mills College Site of the Far West Laboratory's ARTE project. Each of the four cooperating teachers worked with one student teacher in the period from October to December and another in February and March; because of the school's year-round timetable, there were some brief periods when two student teachers worked in one classroom.

The four cooperating teachers were located in the same school, and they participated voluntarily after reading the project proposal. They were attracted by the opportunities the project would provide to help

develop improvements in elementary teacher education, to stretch their own teaching by studying research findings, and to work collaboratively with student teachers, giving and receiving feedback based on the training materials. The student teachers were assigned to the school rather than to the research project; some were even skeptical of the research aspect, which they tended not to understand. Although they lacked their cooperating teachers' initial enthusiasm, they were intrigued by the opportunity to be trained with experienced teachers and they valued the relationships that developed early in their placements as a result of the three-day training experience. Although expensive, this training of cooperating and student teachers together was one of the most successful and promising of the project's strategies.

With some exceptions, the student teachers were more interested in the concept of Active Teaching Behaviors. This is consistent with their natural focus on their own behavior in the classroom. The ATB categories suggested alternatives; the importance of "closure" in a lesson seemed to be noticed by everyone. The cooperating teachers tended to focus their personal attention on Academic Learning Time. All reported that they became more attentive to student engagement and to the significance of noting whether an engaged student was working accurately.

The participants were supplied with forms for coding ATB and ALT and all made some use of the forms. In the absence of specific guidelines about how often the forms should be used, some tended not to use them over long periods. In some instances, cooperating teachers found that student teachers were not ready for the ATB ideas and they focussed their feedback on basic elements of lesson design, returning to ATB when it seemed appropriate. In short, the use of the forms that had been practiced in training sessions was variable and depended in part on the stage of the student teacher's development and the basic reaction of the cooperating teacher to the ideas associated with ALT and ATB and to the forms as a suitable format for feedback.

All participants reported changes in their teaching as a result of the project's ideas and the associated feedback that they received about their teaching. Most student teachers reported changes such as learning to state an objective at the start of a lesson, developing how lessons begin and end, asking "open" questions rather than ones that can be answered simply "yes" or "no," and shifting from a questioning approach to a didactic one because it was more appropriate to young children. The changes reported by the cooperating teachers centered more on how they look at what students are doing as they teach; they belive that they now look more closely at engagement and accuracy of student seatwork. Some noticed the subtle tendency toward more whole-group instruction as a result of the ATB ideas, and they will adjust that in the light of their personal teaching philosophies. They reported the understandable progress they had made in feeling comfortable when observed by "outsiders," and some spoke about the way that being observed made them more conscious of the ATB and ALT ideas as they teach.

The project offered collaboration among cooperating and student teachers and the research project personnel as well as the promise of

efforts to achieve some degree of "parity" across these roles. Not surprisingly, the achievements fell short of the goals. Student teachers' lack of experience is one significant factor; distance and other limits to communication also proved significant. Yet it is important to note that the goal was valued by the participants, and the progress made was appreciated.

Most of these results of the project do not seem to be restricted in any fundamental way to the fact they they were focused on elementary teacher education and the teaching of mathematics. We believe they deserve consideration with respect to the training of secondary science teachers. Although our initial effort to extend this project to secondary science classrooms lacked the resources of time and money that were associated with the ARTE project, the accompanying papers by Bowyer and Russell indicate some of the factors that will be significant in applications of teacher effectiveness findings to preservice and inservice science teacher education.

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